Dartmouth-Hitchcock

Guide for the Identification and Triage of Possible Mechanical Embolectomy Candidates with Acute Ischemic Stroke
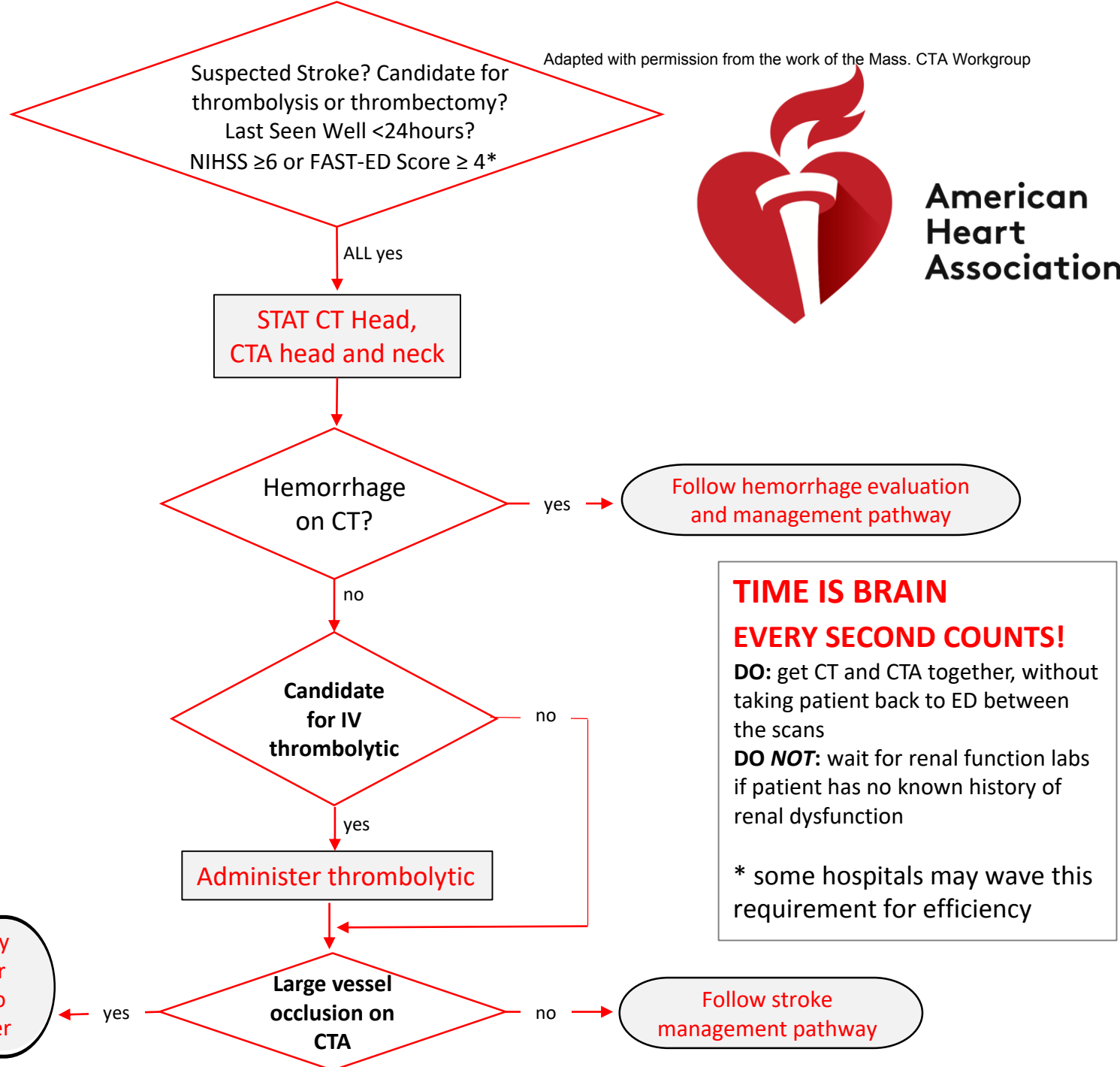
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Disclaimer
The medical information contained in this guide is designed to be used only as a medical and educational reference tool. It is not intended to be used as a diagnostic decision-making system and must not be used to replace or overrule a medical provider's judgment or diagnosis. The responsibility for decisions regarding actual patient care rests solely with the provider treating a patient.

May, 2019

Acute Stroke Imaging and Triage Algorithm

Adapted with permission from the work of the Mass. CTA Workgroup

American Heart Association®

Suspected Stroke? Candidate for thrombolysis or thrombectomy? Last Seen Well <24hours? NIHSS ≥6 or FAST-ED Score ≥ 4*

ALL yes

↓

STAT CT Head, CTA head and neck

↓

Hemorrhage on CT? — yes → Follow hemorrhage evaluation and management pathway

no ↓

Candidate for IV thrombolytic — no →

yes ↓

Administer thrombolytic

↓

Large vessel occlusion on CTA

yes ← Review Embolectomy Criteria and consider emergent transfer to thrombectomy center

no → Follow stroke management pathway

TIME IS BRAIN

EVERY SECOND COUNTS!

DO: get CT and CTA together, without taking patient back to ED between the scans

DO *NOT*: wait for renal function labs if patient has no known history of renal dysfunction

* some hospitals may wave this requirement for efficiency

FAST - ED Scale

Stroke Alert Criteria Met If FAST-ED greater than or equal to 4 AND time last know well is less than 24 hours		
Assessment	**Points**	**Score**
Facial Palsy (ask the patient to smile)		
No facial droop or only minor paralysis on one side of the face	0	
Partial or complete paralysis of one side of the face	1	
Arm Weakness (arms out with palms up for 10 secs)		
No drift, or both arms slowly move down equally	0	
Arm drift or some effort to lift the affected arm against graivity	1	
No effort against gravity or no movement in one or both arms	2	
Speech Change (ask the patient to name 3 common items; ask them to show you 2 fingers		
Able to name at least 2 of 3 objects and follow command	0	
Names none, or only 1 of the 3 items correctly	1	
Unable to "show two fingers" to command	1	
Time - when was patient last know well?		
Eye Deviation		
Able to look to both sides without difficulty	0	
Able to move eyes horizontally in both directions but not without clear difficulty	1	
Gaze is fixed to one side and does not move	2	
Denial/Neglect (only do if there is arm weakness AND commands followed)		
Recognizes weakness in their weak arm and recognizes their weak arm	0	
Unable to recognize weakness when asked "Are you weak anywhere"	1	
Does not recognize own arm when asked "Whose arm is this?"	1	
Total		

Dartmouth-Hitchcock Mechanical Embolectomy Initial Screening Criteria 2019

Inclusion Criteria

- Age: 18 years or greater

- An NIHSS ≥6 or isolated severe aphasia or hemianopia. A FAST-ED Score ≥4 obtained by the EMS or ED Staff is similarly predictive of a MCA occlusion.

- Symptomatic occlusion or stenosis of the MCA stem (M1 and proximal M2 segments), intracranial ICA, or basilar artery is suspected and if arterial imaging is obtained, a potentially treatable lesion is demonstrated on CTA or MRA. Other lesions (e.g., proximal PCA occlusions are treated on a case-by-case basis).

- Basilar artery occlusions should be suspected if there are sudden unexplained posterior circulation symptoms (e.g., diplopia, vertigo, vision loss, slurred speech) associated with a depressed level of consciousness.

- Overall health implies ability to survive procedure (including possible intubation, anesthesia, etc.) and predicted lifespan is long enough to warrant aggressive management.

- In general, do not cause a long delay (ie > 20 minutes) in transferring the patient to obtain imaging beyond a plain head CT if the patient seems to be eligible, for example, a patient with aphasia and right hemiparesis and a hyper-dense left MCA sign on CT. However, obtaining a CTA of the head and neck can be invaluable in triaging these patients and helping the receiving hospital prepare.
  In general, initiation of mechanical embolectomy needs to occur within 24 hours of onset of symptoms. Patients with anterior circulation strokes and symptoms > 6 hours will usually need to meet additional selective criteria that show the infarction is not large including additional imaging (CT or MRI) after arrival at the tertiary center. Transport should be by the fastest feasible mode of transport.

- The time of onset is defined as the last time when the patient was witnessed to be at baseline (i.e., patients who have stroke symptoms upon awakening are considered to have their onset at beginning of sleep). Patients outside this time window MAY be considered at the discretion of the accepting tertiary care center.

Exclusion Criteria

- High density lesion consistent with hemorrhage of any degree, significant mass effect with midline shift, large (>1/3 of the MCA) regions of clear hypodensity on the baseline CT. Sulcal effacement and/or loss of grey-white differentiation alone are not contraindications for treatment.

- Other serious, advanced, or terminal illness with life expectancy < 3 months

- Pre-specified wishes/Dementia: If there is an indication that the patient is significantly demented, or has pre-specified wishes precluding aggressive management, then conservative management should be followed

Based on American Heart/American Stroke Association Guidelines (WJ Powers et al Stroke 2018).

If a patient meets these criteria:

- o Begin electronic image transfer to tertiary referral center if possible

- o Review case with tertiary referral center (see list below). If Tele-Neurology consultant involved, ask to participate in a "3-Way Call" if feasible.

- o Arrange for immediate transport using the fastest mode of transport that is feasible

- o 18g line right antecubital

- o IVF 500ml normal saline bolus

- o If IV t-PA NOT given, give STAT aspirin (81mg chewable x4 or 300 mg PR) or use clopidogrel 75-600 mg (dose per referral center) PO or per nasogastric tube if aspirin allergy present

Albany Medical Center:	1-518- 262-4660
Brigham and Womens:	1-877-637-3337
DHMC: Transfer Center	1-877-999-9870
Lahey Clinic: Lahey TRaC	1-781-744-5130,for transfer use "Stroke Alert" as a key word to expedite transfer
Massachusetts General Hosp	1-617-726-3384 (MD Connect) or 1-617-726-2000(ED triage resident)
Portsmouth Regional Hospital	1-603-433-4982
Maine Medical Center	1-866-662-6632
University of Vermont	1-802-847-7707 (ask for Patient Placement Services)
UMASS(Worcester)	1-888-334-4111 (UMASS Care Connection Center)
Baystate Medical Center	1-877-790-2345
DHART (Air or Ground)	1-603-650-4600 or 1-800-650-3222

Expanded Regional CTA Use for Stroke
(Based on an initiative of the AHA/ASA, Massachusetts Chapter)

Goal
To allow for identification of patients with large vessel occlusions (LVO) at the initial point and time of presentation, and therefore facilitate appropriate transfer and treatment decisions.

CTA is increasingly being utilized in the evaluation of suspected stroke patients. The new data that supports endovascular therapy for patients with identified LVO necessitates that we evolve our approach to these patients. This document provides details of the steps required for this to occur.

Patient Population
CTA should be prospectively obtained for all suspected stroke patients presenting with

1. Significant clinical deficit, as defined by
    a. NIHSS ≥ 6
    b. FAST-ED Score ≥ 4
2. Onset of symptoms <24 hours prior to presentation

Process:
1. <u>Education</u> of local providers regarding target population, changes to imaging approach and goals of this evolution. This includes ED staff, Radiologists, Neurologists, CT technologists, Triage teams, etc.
2. <u>Modification</u> of the acute stroke imaging protocol at each hospital. This modification should include CT angiography (i.e. vessel imaging) for patients with a stroke diagnosis that meet the above criteria. We provide a suggested CTA protocol for acute strokes (head and neck, with delays and overlapping MIP reconstructions). We strongly suggest *replication of this protocol* as closely as possible for local scanners. We have both Neuroradiology and CT technologist support available to assist with accomplishing this.
3. <u>Interpretation</u> of imaging will be determined at individual sites and will vary from site to site. Various options exist, including
    i. local radiology
    ii. remote radiology (e.g. Nighthawk)
    iii. collaboration with a local stroke center, where the interpretation is performed at the "hub" center before shared triage decision making.

    Whatever method is selected, the read must be available rapidly after scan (<15mins). Regardless of method the local radiology team can read the CTA when able and bill for the study.
4. <u>Activation</u> of the protocol for all patients that meet the above criteria. Centers will image appropriate acute stroke patients with head CT, and then *immediately* follow with head and neck CTA. The patient will then be transported back to the emergency department while the CT technologists reconstruct the *axial, sagittal and coronal MIPs*.

5. <u>Decision</u> about triage. Decision-making for acute stroke cases will follow the existing process, where the priority consideration is intravenous Alteplase candidacy. Now with CTA data a further step will be available; determination of the presence of an LVO and rapid assessment of the need for emergent transfer to a thrombectomy-capable facility.
6. <u>Initiate Emergent Transfer</u> in all patients who meet all of the following:

        i. <24 hours from onset of symptoms.
        ii. No large established infarct already seen on CT scan (ASPECTS >6)
        iii. Confirmation of LVO

Early activation of transfer infrastructure will be prioritized. Transfer for other stroke patients will remain at the discretion of the referring hospital. This will allow retention of more of the cases that might otherwise be transferred unnecessarily for consideration of endovascular therapy.

Metrics
As with any process change, it remains essential that delay is not introduced. We do not anticipate that the acquisition and processing of CTA data will meaningfully slow down current workflow.   The DH Stroke Program will continue to monitor these metrics and referral hospitals are encouraged to participate in the quality improvement process throughout the region.

1. Door to Imaging
2. Door to Alteplase
3. Door to transfer time, also known as DIDO (Door In Door Out) time.

It is important to note that the decision to obtain CTA will be made prospectively. Only rare exceptions would be scanned with CT, return to the emergency deparment and then return for CTA.

CT/CTA Imaging
Technical and practical notes:

Before the Arrival of the Patient

- The entire stroke team must keep in mind that "time is brain" and that everything should be prepared for when the patient arrives.
- The activation of the stroke code leads to stopping any non-emergency work at the designated CT scanner.
- The power injector must be loaded with 80 mL of nonionic contrast material (300 mg of iodine per ml).
- In addition, the emergency/radiology department nurse has to gain adequate peripheral venous access with an 18–20-gauge needle to support the 4-5 mL/sec injection rate.
- Any metallic hardware, including dental and hair prostheses, should be removed from the patient.
- The right arm is preferentially selected for IV placement to avoid streak artifacts in the mediastinum from contrast material retained in the left subclavian vein with a left-arm injection.
- The antecubital fossa is preferred for intravenous access over arm-vein or hand-vein access.
- If present. a history of a severe contrast allergy, may contra-indicate doing a CTA.

CT Protocol

- The goal of CT/CTA imaging for acute stroke patients is to obtain the following, in order of importance:
    - CT head. Non-contrast
    - CTA head and neck *(preferably with multiphase imaging of the head).*
    - Axial, sagittal, and coronal *overlapping MIP reconstructions*

- Nonenhanced CT and CT angiography can be performed as a single examination with two separate acquisitions.
- The examination is frequently completed and analyzed within 15 minutes in a real clinical setting using new-generation multidetector CT scanners. A recommended protocol is enclosed.

Nonenhanced CT

- Nonenhanced scanning must be performed as soon as possible after the stroke code has been activated.
- CT is important for the detection of hemorrhage or other possible mimics of stroke (eg, neoplasm, arteriovenous malformation) that could be the cause of the neurologic deficit. Recent hemorrhage is a contraindication to revascularization therapies.
- The second role of nonenhanced CT is the detection of ischemic signs of established infarction. The main CT finding is a hypoattenuating area within a vascular territory.

- The extent of the hypoattenuating area helps determine the amount of tissue that is already infarcted. A large area of hypoattenuation may represent a contraindication to revascularization therapy.

CT Angiography

- The main role of CT angiography is to reveal the status of large cervical and intracranial arteries and thereby help define the occlusion site, grade collateral blood flow, and characterize the aortic arch and the extra and intracranial vessels. This information helps accurately predict the injury caused by the stroke and the role of endovascular reperfusion strategies.

- Postprocessing is performed by the technologist at the scanner or by automated software reconstruction immediately prior to readout. Thick slab, overlapping MIP images of the head are obtained from the skull base to the vertex in axial, coronal, and sagittal planes**.**

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DHMC MULTIPHASE CACO - SIEMENS FORCE

CONTRAST		65CC OMNIPAQUE 350

ACQUISITION 1		**SMART PREP**
SCAN RANGE		AORTIC ARCH
RECON 1	**SCAN TYPE / ROTATION**	FULL / 0.25 SEC ROTATION
	SLICE THICKNESS	10.0mm
	INTERVAL	0.0mm
	SFOV	
	KV	100
	MA	23
	ADMIRE	
	NOISE INDEX	
	RECON TYPE	
	KERNEL	

ACQUISITION 2		**CTA CACO**
SCAN RANGE		CARINA TO TOP OF HEAD
RECON 1	**SCAN TYPE / ROTATION**	0.25 SEC ROTATION
	SLICE THICKNESS	0.6mm
	INTERVAL	0.6MM
	SFOV	
	KV	90 / Sn150
	MA	CAREDose4D
	ADMIRE	3
	NOISE INDEX	
	RECON TYPE	STANDARD
	KERNEL	Br40
RECON 2	**SLICE/INTERVAL**	1.0 q 0.7
	RECON TYPE	STANDARD
	KERNEL	Br40
	ADMIRE	3
RECON 3	**SLICE/INTERVAL**	10.0 q 5.0
(AX MIP THK COW)	**RECON TYPE**	STANDARD
	KERNEL	Br40
	ADMIRE	3
RECON 4	**SLICE/INTERVAL**	10.0 q 5.0
(COR MIP THK COW)	**RECON TYPE**	STANDARD
	KERNEL	Br40
	ADMIRE	3
RECON 5	**SLICE/INTERVAL**	10.0 q 5.0
(SAG MIP THK COW)	**RECON TYPE**	STANDARD
	KERNEL	Br40
	ADMIRE	3

RECON 6	SLICE/INTERVAL	2.0 q 2.0
(COR MIP COW)	RECON TYPE	STANDARD
	KERNEL	Br40
	ADMIRE	3
RECON 7	SLICE/INTERVAL	2.0 q 2.0
(SAG MIP COW)	RECON TYPE	STANDARD
	KERNEL	Br40
	ADMIRE	3
RECON 8	SLICE/INTERVAL	4.0 q 2.0
(COR MIP THK)	RECON TYPE	STANDARD
	KERNEL	Br40
	ADMIRE	3

ACQUISITION 3 — CTA COW

SCAN RANGE		C3 TO TOP OF HEAD
RECON 1	SCAN TYPE / ROTATION	0.25 SEC ROTATION
	SLICE THICKNESS	0.6mm
	INTERVAL	0.6MM
	SFOV	
	KV	90 / Sn150
	MA	CAREDose4D
	ADMIRE	3
	NOISE INDEX	
	RECON TYPE	STANDARD
	KERNEL	Br40
RECON 2	SLICE/INTERVAL	1.0 q 0.7
	RECON TYPE	STANDARD
	KERNEL	Br40
	ADMIRE	3
RECON 3	SLICE/INTERVAL	10.0 q 5.0
(AX MIP THK COW)	RECON TYPE	STANDARD
	KERNEL	Br40
	ADMIRE	3

ACQUISITION 4 — CTA COW

SCAN RANGE		C3 TO TOP OF HEAD
RECON 1	SCAN TYPE / ROTATION	0.25 SEC ROTATION
	SLICE THICKNESS	0.6mm
	INTERVAL	0.6MM
	SFOV	
	KV	90 / Sn150
	MA	CAREDose4D
	ADMIRE	3
	NOISE INDEX	

	RECON TYPE	STANDARD
	KERNEL	Br40
RECON 2	**SLICE/INTERVAL**	1.0 q 0.7
	RECON TYPE	STANDARD
	KERNEL	Br40
	ADMIRE	3
RECON 3	**SLICE/INTERVAL**	10.0 q 5.0
(AX MIP THK COW)	**RECON TYPE**	STANDARD
	KERNEL	Br40
	ADMIRE	3

DHMC MULTIPHASE CACO - GE 64 SLICE

CONTRAST		65CC OMNIPAQUE 350

ACQUISITION 1 — MIROI

SCAN RANGE		ABOVE SHOULDERS
RECON 1	**SCAN TYPE**	AXIAL / FULL / 0.5 SEC ROTATION
	SLICE THICKNESS	5.0MM
	INTERVAL	0.0mm
	SFOV	SMALL BODY
	KV	120
	MA	100
	ASIR	0% / FULL
	NOISE INDEX	
	RECON TYPE	STANDARD
	REFORMATS	NONE

ACQUISITION 2 — CTA CACO

SCAN RANGE		CARINA TO TOP OF HEAD
RECON 1	**SCAN TYPE**	HELICAL / FULL / 0.5 SEC
	SLICE THICKNESS	0.625mm
	INTERVAL	0.625mm
	SFOV	LARGE BODY
	KV	120
	MA	AUTO mA to 700
	ASIR	0% / PLUS-E
	NOISE INDEX	14.14
	RECON TYPE	STANDARD
	REFORMATS	CORONAL 4MM q 2MM MIP
RECON 2	**SLICE/INTERVAL**	0.625 q 0.625
	RECON TYPE	STANDARD
	REFORMATS	10MM q 5MM CORONAL/SAGITTAL/AXIAL MIP, 2MM CORONAL/SAGITTAL MIP

ACQUISITION 3 — CTA COW

SCAN RANGE		C3 TO TOP OF HEAD
RECON 1	**SCAN TYPE**	HELICAL / FULL / 0.5 SEC
	SLICE THICKNESS	0.625mm
	INTERVAL	0.625mm
	SFOV	LARGE BODY
	KV	120
	MA	AUTO mA to 700
	ASIR	0% / PLUS-E

NOISE INDEX		14.14
RECON TYPE		STANDARD
REFORMATS		10MM q 5MM MIP AXIAL

ACQUISITION 4		**CTA COW**
SCAN RANGE		C3 TO TOP OF HEAD
RECON 1	**SCAN TYPE**	HELICAL / FULL / 0.5 SEC
	SLICE THICKNESS	0.625mm
	INTERVAL	0.625mm
	SFOV	LARGE BODY
	KV	120
	MA	AUTO mA to 700
	ASIR	0% / PLUS-E
	NOISE INDEX	14.14
	RECON TYPE	STANDARD
	REFORMATS	10MM q 5MM MIP AXIAL